

THE EFFECTS OF INTERSPERSED TRIALS AND DENSITY OF  
REINFORCEMENT ON ACCURACY, LOOKING AWAY, AND SELF-  
INJURIOUS BEHAVIOR OF A CHILD WITH AUTISM

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This research examines the effects of task interspersal and density of reinforcement on several behaviors of an autistic 6-year-old boy during the performance of a visual matching task and two auditory matching tasks. Experiment 1 investigated the effects of interspersing high and low accuracy tasks on correct matching responses, positions of matching responses, looking away, and self-injurious behavior (SIB). The effects of interspersed trials were evaluated using an ABAB multiple treatments design. Results indicated that interspersed trials produced slightly more correct responses during the visual matching task; however, correct responses decreased during the other two tasks. The use of interspersed trials also decreased looking away from the stimuli and SIB. Experiment 2 evaluated the effects of reinforcement density apart from task interspersal. Two conditions, reinforce-corrects-only and reinforce-all-responses, were compared in Experiment 2. Correct responses increased slightly for all three tasks during the reinforce-all-responses condition. Looking away and SIB were very infrequent throughout Experiment 2.

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## CHAPTER 1

### INTRODUCTION

Teaching children to match to sample is one of the early targets in treatment programs for children with autism. In the basic match-to-sample paradigm, two or more comparison stimuli and a sample stimulus are presented during a series of discrete trials. The individual is shown the sample card and must locate a comparison card that is identical to that card. Selecting the comparison card that is identical to the sample card is followed by reinforcement. Selecting any other card that is not identical to the sample card is not followed by reinforcement. During each trial, the sample and comparison cards vary (for an example see Dube, W.V., McIlvane, W.J., & Green, G. 1992).

Using the basic match-to-sample paradigm, children with autism are usually taught to match picture to picture, word to word, auditory name to picture, auditory name to word, and so on. Of these tasks, the picture-to-picture matching task, often referred to as visual-visual matching, is used to teach basic discrimination skills and is considered the easiest task (Daehler, Lonardo, & Bukatko, 1979). However, typically developing 2-year-old children have more difficulty matching pictures to pictures, a visual task, than matching the auditory names to pictures, a verbal task (Daehler et al., 1979). In Daehler et al. (1979), 24 children were given 21 random trials using three different instructions. The children were either given a verbal instruction, such as “Find the (\_\_\_\_)”, a visual instruction where the instructor held up a picture and said “Find the one like this one,” or a verbal-visual instruction where the instructor held up a picture and stated “Find the

(\_\_\_\_).” The 2-year-old children had more difficulty with the visual only instruction than with the verbal or visual-verbal instruction. Two and half-year-old children scored higher during all three instructional tasks when compared to the two-year-old children’s correct responses. Difficulties with visual-visual matching when compared with auditory name to picture matching have also been documented in children with autism (Kelly, Green, & Sidman, 1998) and in children with brain disease and mental retardation (Rosenberger, Stoddard, & Sidman, 1972).

It is possible that task variables are responsible for difficulties with visual-to-visual matching. For instance, Kelly et al. (1998) showed that differences between training and testing conditions were responsible for a child’s failures in visual-visual discrimination tasks. In their procedures, a change from two comparison stimuli during training to four comparison stimuli during testing broke the control exerted by the pictures. Interestingly, they had to systematically increase the number of comparison stimuli in the training task from two to three until an 80% criterion was met then increase the comparison stimuli four (Kelly et al., 1998). Presenting four comparison stimuli, however, did not disrupt accurate performance when the sample stimulus was a spoken word rather than a picture. Kelly et al. mentioned, but did not address, two other differences between their training and testing procedures that could have also affected the picture-to-picture matching task: the number of trials and the types of stimuli presented.

Several studies have looked at the effects of interspersing tasks the subject can perform correctly with new tasks (Charlop, Kurtz, & Milstein, 1992; Dunlap, 1984; Dunlap & R. L. Koegel, 1980; Horner, Day, Sprague, O'Brien, & Heathfield, 1991; L. K.



Koegel & R. L. Koegel, 1986; Neef, Iwata, & Page, 1980). Interspersing new tasks with known tasks has been successfully used to teach multiplication and division facts to typical children (Cooke & Reichoud, 1996; Cooke, Guzaukas, Pressley, & Kerr, 1993), sight words to children with mental retardation and severe behavior disorders (Browder & Shear, 1996), gross motor skills to children with autism (Weber & Thorpe, 1992), and increase the acquisition rate for spelling new words of two children with mental retardation and a profoundly deaf child (Neef, Iwata, & Page, 1980).

In Charlop et al. (1992), three reinforcement contingencies were compared during the interspersal of acquisition and maintenance tasks using a multiple baseline design across children. Differential reinforcement for correct responses was used along with a prompting technique for acquisition tasks. Praise and a tangible reinforcer were delivered for correct responses to acquisition tasks. For maintenance tasks, either praise was delivered for a correct response or the next trial was presented without delivery of praise or a tangible reinforcer. The results showed that children responded correctly to newly acquired tasks more often when no reinforcement was delivered for maintenance tasks. Correct responding to maintenance tasks remained high when praise was delivered or when no praise or tangibles were delivered.

Neef et al. (1980) also looked at task interspersal. However, they also evaluated the effects of the density of reinforcement when reinforcement was delivered for sitting quietly, “doing your work” and so on in addition to reinforcement contingent on correct spelling (Neef et al., 1980). Three developmentally delayed children were exposed to three conditions where each child was to correctly spell each word. All correct responses

were followed by praise and all incorrect responses were followed by the instructor correcting the error and the child writing the word correctly three times. During baseline, ten unfamiliar words were given. During the high density of reinforcement condition, ten unfamiliar words were given and praise was delivered contingent on paying attention, writing neatly, and attempting to write the words. During the interspersal condition, ten unfamiliar words and ten words the child had a history of spelling correctly were given. The results indicated that the children mastered more words during the interspersal condition than either baseline or high-density reinforcement conditions.

Dunlap and Koegel (1980) also found that varying the tasks so that the child was successful also increased the number of correct responses. These authors evaluated the effects of a constant task versus a varied task on unprompted correct responses, child affect, and positive or negative teacher interactions using a multiple baseline across behaviors design. Correct responses for all trials were followed by praise. Incorrect responses were followed by the instructor guiding the child to make the correct response. During the constant task condition, two children with autism were exposed to a repeated presentation of one of three unfamiliar tasks, such as identifying body parts and matching alphabet letters. During the varied task condition, the children were exposed to one unfamiliar task and several previously learned tasks, such as identifying colors, building block towers, and answering yes or no questions. A 6-point rating scale was used to score child affect as happy, interested, or well behaved. Based on the 6-point scale, the child's interactions were noted as "positive", "neutral", or "negative." Children had a higher percentage of unprompted responses during the varied task condition compared to the

constant task condition. Children also had more “positive” interactions during the varied task condition compared to the constant task condition.

Dunlap (1984) used the same procedures for correct and incorrect responding as in Dunlap and Koegel (1980). Dunlap (1984) compared three conditions to evaluate the number of trials five children with autism needed to acquire a task and the child’s affect during each condition. During the constant task condition, one of five new tasks was given repeatedly throughout a 15-min session. During the varied acquisition task condition, all five new tasks were interspersed. During the varied acquisition with maintenance conditions, all five new tasks were interspersed with previously learned tasks. The results showed that fewer trials were needed to acquire the acquisition tasks and more “positive” interactions were noted during the varied acquisition tasks when maintenance tasks were given as compared to the constant task condition and varied acquisition task condition.

Horner et al. (1991) compared the effects of three conditions on self-injurious behavior and attempts to complete a task. Three children with severe mental retardation served as subjects. During the “easy task” condition, only tasks where the subject could perform correctly at least 70% of the trials were given. These “easy tasks” included pouring water from a pitcher to a container, imitating the instructor when the instructor said “Do this”, and putting on a shirt. During the “hard tasks”, only tasks the subject performed correctly on 33% or fewer trials were given. These “hard tasks” included sorting silverware, following a two-step direction (e.g., “Stand up and clap your hands”, and putting on underwear. During the hard tasks plus interspersed maintenance tasks

condition, hard tasks were included with tasks the subject had a history of performing correctly. Maintenance tasks included simple instructions, such as “Give me a high five”, “Give me the pen”, or “Put this in your pocket.” The results indicated that there was almost no aggression during the easy tasks. There was little or no aggression during the hard plus interspersed maintenance tasks when compared to the hard tasks condition. There were more attempts to complete a task during the easy tasks and hard plus interspersed maintenance tasks conditions for two subjects. The third subject attempted to perform the tasks regardless of the condition in place.

Research has shown that interspersal of less successful tasks with more successful tasks can increase attending (i.e., looking at the stimuli, hands on lap, eye contact with the experimenter) and increase the number of attempts to complete a less successful task (Charlop et al., 1992; Dunlap, 1984; Dunlap & Koegel, 1980; Horner et al., 1991; L. K. Koegel & R. L. Koegel, 1986; Neef et al., 1980; Weber & Thorpe, 1992) and reduce self-injurious behavior (Horner et al., 1991).

This experiment was also concerned with self-injurious behavior and looking at the stimuli during three tasks. In addition, this experiment also addressed the discrepancy in accuracy of performance between visual-visual and auditory-visual tasks, such as Kelly et al (1998) investigated. Unlike the Kelly et al. (1998) study, the present experiment examined the phenomenon during training conditions only. The purpose of this experiment was to examine the effects of interspersing high and low accuracy matching tasks on the accuracy of responding, looking away, and face hitting episodes of a child with autism.

## CHAPTER 2

### EXPERIMENT 1

#### METHODS

##### Participant

The participant was a 6-year-old boy with diagnoses of autism, speech disorder, and grand mal seizure disorder. The diagnosis of autism was based on the Muskegon Index of Autistic Behavior Revised. Jimmy had been in an applied behavior analysis treatment program since he was two years old. When Jimmy was 5 years old, his developmental age ranged between a 16-20 month level based on the Psycho Educational Profile Revised (PEPR). At the time of this experiment, Jimmy attended a regular first grade classroom in the mornings with the support of a school therapist. He communicated with approximately 30 intelligible words most of which were one-to-two-word utterances.

##### Setting and Materials

The study was conducted in Jimmy's bedroom at his home. His room contained a bunk bed, a dresser, several books on the dresser, a chest of drawers, two sets of stackable plastic containers that contained several toys, a toy chest filled with stuffed animals, and a small table with two chairs. The room was isolated from other areas in the house, thus, limiting disruptive noise. A video camera was present during 54 % of the sessions. Jimmy was seated in a small chair facing a child-sized table. The experimenter sat on the floor to the front and right of the child. The experimental materials were presented at the table.

The stimulus materials consisted of three colored pictures (a horse, an apple, and an ice cream) displayed on 8.1 cm by 13.2 cm white cards (see Figure 1). All three colored pictures had an identical card utilized as a sample and comparison stimuli during the matching tasks. The other cards from the pairs were used as comparison stimuli. Thirteen items were used as reinforcers throughout the experiment. They were a tape player, a piano, two See-n-Says, five different music toys, two books, a phone, and an airplane.

#### Dependent Variables

The dependent variables in this study were face hitting episodes, looking away, the accuracy of matching responses, and the position of matching responses.

Face hitting episodes. Face hitting was defined as contact with the facial region by the palm or outer portion of the hand or fingers of the right or left hand with sufficient force to create an audible sound. This definition also included occasions when the palm of either the right or left hand contacted the other hand with sufficient force to create an audible sound while one hand was in contact with the facial region. Because face hits frequently occurred in very rapid bursts, face hits were not scored individually, rather, face hitting episodes were scored. An episode was scored each time the child's right or left hand moved toward his facial region, contacted the facial region, then lowered toward the table, his side, or his lap. A face hitting episode could consist of several successive occurrences or a single occurrence of face hitting. An episode was scored only if the behavior occurred between the time the stimuli were presented on the table to

the time when the stimuli were removed from the table. Face hitting episodes were not counted if they occurred during reinforcer times or between trials.

Looking away responses. Looking away was scored if, while placing the card on the table or picking up a card from the table, the child turned his head to either side of the table away from the comparison stimuli. Looking away was also scored if, while attempting the matching responses, the child looked straight ahead or down at his body rather than toward the stimuli on the table.

Accuracy of matching responses. For picture-to-picture matching and picture plus auditory name-to-picture matching, a correct matching response was counted when the child placed the picture card handed to the child by the experimenter on top of an identical picture on the table. An incorrect matching response consisted of the child either placing the sample card between two comparison pictures or placing the card on top of a comparison picture that did not match the sample picture. For auditory name-to-picture matching, a correct response was counted when the child handed the experimenter the card that matched the name spoken by the experimenter. An incorrect matching response consisted of the child handing the experimenter a card that did not match the spoken name. An incorrect matching response was also scored if the child did not respond within 5s following the experimenter's instruction.

Position of matching responses. Each time the child placed the card on the table or selected a card, the position of the card placements was recorded as either on the right, center, or left side. If the child placed the card in the middle of two cards, the response was noted as "in-between" and was not counted as a right, center, or left position.

## Procedures

Sessions were conducted about three times per week. One session was conducted per day and three experimental tasks were completed during a session. In the beginning of Experiment 1, two of the sessions were completed in the morning. After the school year began, all weekly sessions were conducted in the afternoon. This change to all afternoon sessions occurred at session 32.

General procedures. At the start of each experimental task, the child was instructed to sit in the chair. The experimenter sat on the floor next to the child. The experimenter evenly spaced the comparison stimuli on the table approximately 2.3 cm apart from each other and 7.5 cm away from the child.

The three stimuli presented were a picture of a horse, a picture of ice cream, and a picture of an apple. Stimuli were presented according to one of two trial sequences. In each trial sequence, the positions of the three stimuli were counterbalanced so that each stimulus was presented on the right, center, and left side an equal number of times. In addition, correct stimulus choices were equally distributed on the right, center, and left side. Figure 2 shows the locations of the three stimuli for the assigned patterns.

Before the experimenter began a trial, she waited 5s for the child to make eye contact without engaging in stereotypy and with his hands touching his lap. If after 5s, the child had not made eye contact, the experimenter said, “Get ready.” If the child did not place his hands on his knees and make eye contact when given the instruction “Get ready”, the experimenter continued to wait for the child to make eye contact without engaging in stereotypy and with his hands on his lap before she began the trial.



Each task consisted of nine trials; three per stimulus sample. Following the presentation of all nine trials of a task, the experimenter waited for eye contact and then allowed Jimmy to leave the table. Jimmy could then play for approximately 4 to 7 min. After the time elapsed, Jimmy was instructed to sit down and then the next set of nine trials was presented. Following completion of the second task, Jimmy was allowed to leave the table again and play for approximately 4 to 7 min. After time elapsed, Jimmy was instructed to sit down and the last set of nine trials was presented. The session ended after all nine trials of the three experimental task had been presented.

Experimental tasks. The three tasks were picture-to-picture matching, picture plus auditory name-to-picture matching, and auditory name-to-picture matching. During picture-to-picture matching, the experimenter presented the sample stimulus card and simultaneously said, “match.” She then waited 5s for Jimmy to respond. During picture plus auditory name-to-picture matching, the experimenter presented the sample stimulus card to Jimmy and simultaneously said, “match (name of picture).” Then, she waited 5s for the child to respond. During auditory name-to-picture matching, the experimenter said “Give me (name of picture)” while holding out her hand.

In each task, if the child responded correctly, praise (i.e., “Good job,” “That’s right,” or “Alright Jimmy!”) and a tangible reinforcer (i.e., See-n-Say) were delivered. Immediately after praise and a tangible reinforcer were delivered, the experimenter removed all stimuli from the table. After the reinforcer was removed, the next trial was presented. If the child matched incorrectly, the experimenter did not deliver praise and removed the stimuli from the table. After a 5s pause, the next trial was presented. If the

child matched incorrectly to either two consecutive trials or on the very last trial of a set, the experimenter presented two consecutive motor imitation trials or instructions that the child could perform. Praise and a tangible reinforcer were delivered for accurate motor imitations and instruction following. The motor imitations or simple instructions were given to prevent extended periods of time without reinforcement.

### Design

An ABAB multiple treatments design was utilized so that the effects of the two independent variables could be compared (Heward, W. L., 1987, p. 167). The two conditions were blocks of trials (A) and interspersed trials (B).

Blocks of trials. During this condition, blocks of nine trials for each experimental task were presented. At the beginning of the first blocks of trials and for a majority of the second blocks of trials condition, the picture-to-picture matching task was presented in the first set of nine trials, the picture plus auditory name-to-picture matching task was second, and the auditory name-to-picture matching task was third. The order of the tasks was occasionally changed so that the auditory name-to-picture matching task was presented first, the picture plus auditory name-to-picture matching task was second, and the picture-to-picture matching task was third.

Interspersed trials. During this condition, the three different experimental tasks were randomized within the three sets of nine trials. In a set of nine trials, each experimental task was presented three times. The different types of trials were presented according to one of two trial sequences (see Figure 3).

## CHAPTER 3

### EXPERIMENT 1

### RESULTS

Figure 4 shows the accuracy of matching responses for picture-to-picture matching (top), auditory name-to-picture matching (middle), and picture plus auditory name-to-picture matching (bottom) during both conditions: Blocks of trials and interspersed trials. Along the ordinate, the number of correct matching responses is shown. The total number of possible correct matching responses for each experimental task is nine. During the first blocks of trials condition, the mean number of correct matching responses for picture-to-picture matching (PPM) was 4.4, for auditory name-to-picture matching (APM) was 7.7, and for picture plus auditory name-to-picture matching (P+APM) was 7.4. When interspersed trials was introduced, the mean number of correct matching responses was 5.9 for PPM, 7.6 for APM, and 7.1 for P+APM. During the re-introduction of blocks of trials, the mean number of correct matching responses was 4.3 for PPM, 6.7 for APM, and 6.6 for P+APM. In the last condition of interspersed trials, the mean number of correct matching responses was 5.2 for PPM, 5.9 for APM, and 6.0 for P+APM.

A visual examination of the APM figures did not reveal any trends within either the blocks of trials or interspersed trials conditions. A slight downward trend was seen across the four conditions, however. During P+APM, there was a very slight downward trend seen in both blocks of trials conditions, as well as an overall downward trend across all four conditions.

Figure 5 shows the positions of matching responses for the PPM (top), the APM task (middle), and the P+APM task (bottom) for both conditions: Blocks of trials and interspersed trials. The graph shows data for the positions for right, center, left, and in between two cards. The ordinate displays the number of possible card placements to any of the three positions. In evenly distributed performance, all right, center, and left card placements will cluster on the number three. Numbers higher than three indicate a tendency to place cards in a particular position. During the first blocks of trials condition, the subject tended to place cards more to the center position during PPM, distribute right, center, and left card placements closer to the number three during APM and P+APM. However, card placement deviated slightly from the number three in the last three sessions during the P+APM task. When interspersed trials was introduced, the position of card placements began to vary more, there were more card placements toward the center and to the right for PPM, more card placements to the left and right during APM, and more card placements toward the center for P+APM. During the re-introduction of blocks of trials, center position card placements began to increase while left and right card placements were low for PPM, left, center, and right position placements began to move closer to the number three for APM, and card placements to the center began to increase while left and right position placements were low for P+APM. In the last condition of interspersed trials, the subject placed cards predominately to the center with few or no placements to the left and right positions during PPM and P+APM. During APM, however, variability in card placement increased, this time with a slight tendency to place cards to the right.

Overall, the card placements for both PPM and P+APM tended to deviate from the number three across all four conditions indicating unevenly distributed performance. For both PPM and P+APM, more card placements occurred toward the center position; this is most apparent in the last interspersed trials condition. During APM, more evenly distributed card placements occurred in the first blocks of trials when compared to the other three conditions.

Figure 6 shows the total number of trials where the child looked away during PPM (top), APM (middle), and P+APM (bottom) during both conditions. Looking away responses are shown in a cumulative record format. The solid vertical lines indicate reset lines. In the first blocks of trials condition, looking away occurred on 31 trials during PPM and 8 times during both APM and P+APM. When interspersed trials was introduced, looking away occurred on 8 trials for PPM, 4 for APM, and 3 for P+APM. During the re-introduction of blocks of trials, looking away occurred on 32 trials for PPM, 8 trials for APM, and 19 trials for P+APM. In the last condition of interspersed trials, looking away occurred on 8 trials for PPM, 3 trials for APM, and 11 trials for P+APM.

These results show a difference in the number of looking away responses between the blocks of trials conditions and the interspersed trials conditions during PPM. During APM, there was also a difference in the number of trials in which looking away occurred between blocks of trials and interspersed trials. During P+APM, there was a difference between the first blocks of trials and the first interspersed trials condition; however, there

was an increase in looking away that occurred in the last blocks of trials and interspersed trials conditions.

Figure 7 shows the total number of trials where face hitting occurred during PPM (top), APM (middle), and P+APM (bottom). The data are shown in a cumulative record format. During the first blocks of trials condition, the total number of face hitting episodes during PPM and APM was 6 and for P+APM the total number of face hitting episodes was 3. During the first interspersed trials condition, 2 face hitting episodes occurred during PPM, 3 face hitting episodes occurred during APM, and 4 face hitting episodes occurred during P+APM. During the re-introduction of blocks of trials, face hitting episodes totaled 10 for PPM, 5 for APM, and 5 for P+APM. In the last interspersed trials condition, there were no face hits during PPM. The total number of face hitting episodes was 3 during APM and 2 during P+APM.

There was a difference in the number of face hitting episodes that occurred during the blocks of trials conditions and the interspersed trials conditions during PPM. There was also a difference between the number of face hitting episodes that occurred during blocks of trials and interspersed trials during APM, although the difference was slight.

#### Interobserver agreement

A second observer, who received training from the experimenter, viewed the videotapes of the sessions. A minimum of 25% of the sessions per each condition was recorded. Interobserver agreement for all dependent measures was calculated by the number of trial agreements in each reliability session divided by the number of trial

agreements plus the number of trial disagreements in each reliability session multiplied by 100. An trial agreement for the accuracy of matching responses and positions of matching responses was defined as the experimenter and an observer recording the placement or selection of the card in the same location, either right, center, or left, for each trial. A trial agreement for looking away and face hitting was defined as both the experimenter and observer recording an occurrence of the behavior in the appropriate trial. The percentage of interobserver agreement for accuracy of matching responses was 97% (range: 85-100%), position of matching responses was 96% (range: 84-100%), looking away was 89% (range: 70-100%), and face hitting episodes was 99% (range: 96-100%).

## CHAPTER 4

### EXPERIMENT 1

### DISCUSSION

This experiment examined the effects of task interspersal on the accuracy of matching, position of matching responses, looking away from the stimuli, and face hits. In general, accuracy was slightly higher during the interspersed trials condition in the picture-to-picture matching task. There was a reduction in face hitting and looking away in the interspersed trials condition during all three tasks when compared to the blocks of trials conditions.

Results showing a decrease in face hitting and looking away support previous research indicating that interspersal of high and low accuracy tasks reduces self-injurious behavior and other non-task related responses (Charlop et al., 1992; Horner et al., 1991). Presumably, interspersal of tasks is successful because it increases the overall density of reinforcement relative to blocks of low accuracy tasks. This increased density of reinforcement may promote attending to stimuli, making possible the reduction of incorrect responses, which in turn reduces emotional responding (i.e., crying, throwing objects, and non-responding) that can interfere with task performance (Horner et al., 1991).

Although the effects of interspersed trials on looking away and face hitting were clear, the effects of using interspersed trials on accuracy were mixed. For instance, interspersed trials produced a slight increase in the accuracy for PPM but produced no difference in the other two tasks. Further, there was an overall decrease in accuracy for



the other two tasks across the blocks of trials and interspersed trials conditions. This decrease in accuracy for the other two tasks resulted in lower accuracy during the final interspersed trials condition compared to initial baseline performance.

Changes in accuracy may have been related to the position the child most often placed the card. During PPM and P+APM, the child predominately placed the card to the center position. In the interspersed trials conditions, however, there were fewer card placements to only one position and placements were more evenly distributed across the three positions during APM.

Increasing overall attending to the tasks provides some of the conditions necessary to facilitate learning but other variables may also be important (Charlop et al., 1992; Dunlap, 1984; Dunlap & Koegel, 1980; L. K. Koegel & R. L. Koegel, 1986; Horner et al., 1991; Neef et al., 1980). Typically, studies have used interspersal tasks that were performed accurately such as “clap your hands” and “touch your nose”. In this study, the three tasks were very similar in difficulty and none of them were reliably completed correctly. Also, the three tasks in this experiment were similar in topography. In other studies interspersal tasks have been very different in topography from the acquisition task. For example, if the acquisition task was to draw a circle the interspersal task may have been to clap hands or touch head. In this study, the three experimental tasks consisted of matching one of three cards on the table or picking up a card off the table. Additionally, other experiments used different prompting techniques, such as graduated guidance or prompt fading (Charlop et al., 1992; Dunlap, 1984; Dunlap & R.

L. Koegel, 1980; Horner et al., 1991; L. K. Koegel & R. L. Koegel, 1986; Neef et al., 1980; Weber et al., 1992). No prompting techniques were used in Experiment 1.

Other studies have reported increases in accuracy when using task interspersal plus some error correction procedure, such as hand over hand guidance (Dunlap, 1984; Dunlap & R. L. Koegel, 1980; Horner, et al., 1991; L. K. Koegel & R. L. Koegel, 1986). These studies have suggested that increases in accuracy were due to increases in the density of reinforcement (Charlop et al., 1992; Dunlap, 1984; Dunlap & R. L. Koegel, 1980; Horner, et al., 1991; L. K. Koegel & R. L. Koegel, 1986). In this study, task interspersal had detrimental effects on accuracy during high accuracy tasks. Separating the effects of density of reinforcement and error correction from task interspersal may help to suggest reasons for the disagreement between the findings of other experiments and the results of this study. A second experiment was conducted to examine the effects of the density of reinforcement and error correction, independently of task interspersal. Two conditions were compared: reinforce-corrects-only and reinforce-all-responses.

CHAPTER 5  
EXPERIMENT 2  
METHOD

Participant, materials, and procedures

The participant, setting, tasks, behaviors measured, and the procedures were the same as in Experiment 1. A video camera was present during 50% of the sessions. The materials were also the same with the exception of some of the reinforcers. The reinforcers used in this experiment were two See-n-Says, an airplane, four music toys, a phone, a piano, and a Frisbee. After session 4, the piano, the phone, one See-n-Say, and one music toy were no longer utilized. As in Experiment 1, sessions consisted of the presentation of the three nine-trial tasks using the blocked-trials format.

Design

An ABAB multiple treatments design was used in Experiment 2. The two conditions were reinforce-corrects-only (A) and reinforce-all-responses (B).

Reinforce-corrects-only. During this condition, praise and tangible items followed correct matching responses. Incorrect matching responses were followed by the removal of the stimulus materials.

Reinforce-all-responses. During this condition, praise (i.e., “Good job,” “That’s right,” or “Alright Jimmy!”) and a tangible reinforcer (i.e., See-n-Say) were delivered for both correct and incorrect matching responses. If the child matched incorrectly, the experimenter would deliver praise and then said “This is matching name of object” or “This is giving me the name of object” while simultaneously prompting Jimmy with hand

over hand guidance to make the correct response. Following the correction procedure, the experimenter immediately handed the tangible reinforcer to the child.

## CHAPTER 6

### EXPERIMENT 2

#### RESULTS

Figure 8 shows the accuracy of matching responses for PPM (top), APM (middle), and P+APM (bottom) during the reinforce-corrects-only and reinforce-all-responses conditions. Also shown are the subject's self-corrections. A self-correction was scored when the subject placed the sample card on an unidentical comparison card, looked at the correct comparison stimulus, then moved the sample from the unidentical card to the correct comparison stimulus within 5-s. During the first reinforce-corrects-only condition, the mean number of accurate matching responses for PPM was 2.7, for APM was 6.9, and for P+APM was 3.8. During the reinforce-all-responses condition, the mean number of accurate matching responses was 4.5 for PPM, 7.3 for APM, and 6.7 for P+APM. During the re-introduction of the reinforce-corrects-only, the mean number of accurate matching responses was 3.0 for PPM, 6.4 for APM, and 6.2 for P+APM. In the last reinforce-all-responses condition, the mean number of accurate matching responses was 3.8 for PPM, 7.0 for APM, and 6.1 for P+APM. Self-corrections occurred only during the last condition of the experiment. When self-corrections were included in the mean score during the last reinforce-all-responses condition, the mean number of accurate matching responses was 5.7 for PPM and 6.8 for P+APM.

Accurate matching responses for PPM was low during the first reinforce-corrects-only condition but then there was an increasing trend in the reinforce-all-responses condition. During the third condition, accurate matching responses totaled three per

session. In the last reinforce-all-responses condition, accurate matching responses increased slightly. During APM, there was a downward trend in the last four sessions of the first reinforce-corrects-only condition. Accuracy of matching increased in the reinforce-all-responses condition. A similar trend was seen in the last two conditions. Accurate matching responding for P+APM began low in the first reinforce-correct-only but then increased in the reinforce-all-responses condition. In the third condition, matching did not increase and accurate matching did not recover in the last reinforce-all-condition. The child began to correct his errors in PPM and P+APM, two tasks that were very similar in topography.

Figure 9 shows the positions of matching responses for the PPM (top), APM (middle), and P+APM (bottom) for both conditions: Reinforce-corrects-only and reinforce-all-responses. Self-corrections are not included. During the first reinforce-corrects-only condition, the subject tended to place cards mostly to the right position during PPM and P+APM. Right, center, and left card placements clustered toward the number three in sessions 72 through 78 during APM, however, card placements began to deviate slightly from the number three in the last session during reinforce-corrects-only. When reinforce-all-responses was introduced, there were more right position card placements in the first five sessions but card placements shifted to more left in the latter sessions during PPM, right, center, and left card placements remained close to the number three during APM, and during P+APM, card placements initially occurred toward the right, then clustered around the number three. During the second reinforce-corrects-only condition, all card placements, except for one right placement, were to the

left during PPM, left, center, and right position card placements remained close to the number three for APM, and more left card placements occurred during P+APM. In the last reinforce-all-responses condition, card placements were mostly to the left, right placements decreased to zero in the last 5 sessions, and center placements also declined. Right, center, and left card placements began to cluster toward the number three during APM and left card selections decreased while center, and right position card selections increased during the last sessions during P+APM.

There were several card placements to the right in the first reinforce-corrects-only condition and in the beginning of the reinforce-all-responses condition during PPM. There was a shift to left card placements that occurred in the middle of the reinforce-all-responses condition, however, there was also more right and center placements that clustered around the number three. When reinforce-corrects-only was re-introduced, all but one of the card placements were to the left. This predominant left card placement resulted in the stable number of only three correct matches per session in the third condition of PPM in Figure 8. Left card placements continued to be the dominant matching response during the final reinforce-all-responses condition. For APM, card placements were more evenly distributed across the four conditions, however, the most evenly distributed card placements occurred in the first reinforce-all-responses condition. During P+APM, there were several right card placements in the first reinforce-corrects-only condition, then card placements were more evenly distributed in the initial reinforce-all-responses condition. However, this even clustering did not occur in the second reinforce-all-responses condition.

Figure 10 displays the number of trials in which the child looked away during PPM (top), APM (middle), and P+APM (bottom) in a cumulative record format. In the first reinforce-corrects-only condition, looking away occurred 23 times during PPM, 2 times during APM, and 23 times for P+APM. During the reinforce-all-responses condition, looking away occurred 9 times for PPM, 2 times for P+APM, and 3 times during APM. In the second reinforce-corrects-only condition, looking away occurred 4 times for PPM, 5 times for APM, and 1 time for P+APM. In the last reinforce-all-responses condition, no looking away responses occurred in any of the three experimental tasks.

Figure 11 shows the total number of face hitting episodes that occurred during the PPM (top), APM (middle), and P+APM (bottom). Face hits are displayed in a cumulative record format. In the first reinforce-corrects-only condition, the total number of face hitting episodes during PPM was zero, for APM was 2, and for P+APM was 1. When reinforce-all-responses was introduced, no face hits occurred during PPM, 1 occurred during APM, and 3 occurred during P+APM. In the second reinforce-corrects-only condition, face hitting episodes occurred 1 time for PPM, zero for APM, and 1 time for P+APM. In the last reinforce-all-responses condition, the total number of face hitting episodes decreased to zero during both PPM and APM and 1 occurred during P+APM.

#### Interobserver agreement

A second observer, who received training from the experimenter, viewed the videotapes of the sessions. A minimum of 25% of the sessions per each condition was recorded. Interobserver agreement was measured and calculated the same as in



Experiment 1. The percentage of interobserver agreement for accuracy of matching responses was 99% (range: 89-100%), position of matching responses was 97% (range: 78-100%), looking away was 91% (range: 78-100%), and face hitting episodes was 99% (range: 94-100%).

CHAPTER 7  
EXPERIMENT 2  
DISCUSSION

This experiment examined the effects of reinforcing-all-responses on the accuracy of matching, position of matching responses, looking away from the stimuli, and face hits. Reinforcing-all-responses produced a slightly higher mean of correct matching responses compared to the reinforce-corrects-only condition. Initially, in Experiment 2, looking away was high during the first reinforce-corrects-only condition but neared zero levels across the remaining conditions. Little face hitting occurred during either the reinforce-all-responses condition or reinforce-corrects-only condition. During the reinforce-all-responses condition, Jimmy tended to evenly distribute card placements across the three positions. Whereas in the reinforce-corrects-only condition, Jimmy was less likely to vary the position of card placement within a single task.

Variability in card placements, however, did not increase the number of correct placements. There was little difference in card placement accuracy during the reinforce-all-responses condition as compared to the reinforce-corrects-only condition. These results are similar to the findings of Experiment 1, in that amount variation in position of card placements within a task seemed to correspond to a particular experimental condition and that this variation did not seem to be related to the accuracy of card placements.

One of the differences in Experiment 2 and other studies regarding density of reinforcement was that in Experiment 2, the density of reinforcement was changed

without modifying the task presented. In Altman, Hobbs, Rogers, and Haavik (1980), tasks of varying degrees of difficulty were presented to the subjects. The density of reinforcement was considered high, medium, or low based the percent of correct answers. Therefore, density of reinforcement was not directly manipulated but rather was a by-product of task difficulty. In this experiment, the density of reinforcement was increased to 100 percent for all card placements during the reinforce-all-responses condition without altering the tasks presented.

At the end of Experiment 2, Jimmy began to place the sample card on top of an incorrect choice card then move the sample card to the correct choice card. However, because this self-correction occurred only at the end of the final reinforce-all-responses condition and self-corrections did not occur reliably, it is impossible to definitively attribute these self-corrections to any controlling variables.

## CHAPTER 8

### GENERAL DISCUSSION

Some researchers have found that task interspersal plus a prompting procedure increased correct responding and decreased non-task related behavior (Charlop et al., 1992; Dunlap, 1984; Dunlap & R. L. Koegel, 1980; Horner, et al., 1991; L. K. Koegel & R. L. Koegel, 1986). These researchers suggest, without directly examining the effects of density of reinforcement, that increases in density of reinforcement during task interspersal maybe responsible for changes in responding during tasks. Experiments 1 and 2 of this study were designed to allow for the evaluation of increases in density of reinforcement. Both the task interspersal and reinforce-all-responses conditions failed to show clear increases in accuracy of task performance.

The failure of this study to demonstrate clear increases in accuracy using task interspersal or increased density of reinforcement may be attributed to a few possibilities. One possibility is that the similarity in topography of the 3 tasks effected performance during task interspersal. A second possibility is that the pre-experimental history the child had with the stimuli effected accuracy. Third, the lengthy conditions during task interspersal may have effected accuracy of performance. Fourth, other experiments used different prompting techniques, such as graduated guidance or prompt fading. No prompting technique was used in Experiment 1. Any of the above differences may have contributed to the disagreement between the results of Experiment 1 and the results of other studies on tasks interspersal.

Task interspersal, however, did result in decreases in looking away and face hitting during Experiment 1. Similarly, other studies using task interspersal have reported decreases in self-injurious or disruptive behavior and increases in attending (Charlop et al., 1992; Dunlap, 1984; Dunlap & R.L. Koegel, 1980; Horner et al., 1991; Neef et al., 1980; Weber & Thorpe, 1992).

During both Experiment 1 and 2, there was greater variability in the position of card placements during the interspersal and reinforce-all conditions as compared to the blocks-of-trials conditions. However, during the last condition of Experiment 2, self-corrections began to occur.

At the end of Experiment 2, Jimmy began to place the sample card on top of an incorrect choice card then move the sample card to the correct choice card. However, because this self-correction occurred only at the end of the final reinforce-all-responses condition and self-corrections did not occur reliably, it is impossible to definitively attribute these self-corrections to any controlling variables. The inability to evaluate these self-corrections is one of the weaknesses of this study. Perhaps the self-corrections observed in the final condition of Experiment 2 may have eventually resulted in an increase in accuracy had that phase continued. However, the final experimental condition was not sufficiently long to further investigate the nature of these self-corrections.

One future direction could be to further evaluate the role of self-corrections. One method of evaluating self-corrections may be to use a modeling procedure rather than a hand-over-hand error correction procedure during the reinforce-all responses condition. This modified procedure would help determine whether self-corrections were a result of

increased density of reinforcement rather than a results of the hand-over-hand error correction procedure. It may also be possible to evaluate the use of hand-over-hand error correction while reinforcing only correct matching responses. This procedure would help determine whether self-corrections were a result of the error correction procedure rather than an increase in the density of reinforcement.

## APPENDIX

Figure 1. The three colored pictures (i.e., a horse, ice cream, and an apple) used as sample and comparison stimuli.





Figure 2. The locations of the three comparison stimuli or pictures for pattern 1 (top) and pattern 2 (bottom) when using the blocks of trials format. The names in bold indicate the correct response for that trial.

Pattern 1

1	ice cream	apple	<b>horse</b>
2	<b>apple</b>	horse	ice cream
3	<b>horse</b>	ice cream	apple
4	apple	<b>ice cream</b>	horse
5	ice cream	<b>horse</b>	apple
6	<b>ice cream</b>	apple	horse
7	horse	ice cream	<b>apple</b>
8	horse	<b>apple</b>	ice cream
9	apple	horse	<b>ice cream</b>

Pattern 2

1	horse	<b>apple</b>	ice cream
2	apple	horse	<b>ice cream</b>
3	<b>horse</b>	ice cream	apple
4	ice cream	<b>horse</b>	apple
5	<b>ice cream</b>	apple	horse
6	horse	ice cream	<b>apple</b>
7	apple	<b>ice cream</b>	horse
8	ice cream	apple	<b>horse</b>
9	<b>apple</b>	horse	ice cream

Figure 3. The locations of the three stimuli or pictures for pattern 1 (top) and pattern 2 (bottom) with each different task instruction for every trial. The names in bold indicate the correct response for that trial.

### Pattern 1

Give me "n of pic"  
 Match "n of pic"  
 Match  
 Match  
 Match "n of pic"  
 Give me "n of pic"  
 Give me "n of pic"  
 Match  
 Match "n of pic"

1	ice cream	apple	<b>horse</b>
2	<b>apple</b>	horse	ice cream
3	<b>horse</b>	ice cream	apple
4	apple	<b>ice cream</b>	horse
5	ice cream	<b>horse</b>	apple
6	<b>ice cream</b>	apple	horse
7	horse	ice cream	<b>apple</b>
8	horse	<b>apple</b>	ice cream
9	apple	horse	<b>ice cream</b>

### Pattern 2

Match "n of pic"  
 Match  
 Give me "n of pic"  
 Match  
 Give me "n of pic"  
 Give me "n of pic"  
 Match "n of pic"  
 Match "n of pic"  
 Match

1	horse	<b>apple</b>	ice cream
2	apple	horse	<b>ice cream</b>
3	<b>horse</b>	ice cream	apple
4	ice cream	<b>horse</b>	apple
5	<b>ice cream</b>	apple	horse
6	horse	ice cream	<b>apple</b>
7	apple	<b>ice cream</b>	horse
8	ice cream	apple	<b>horse</b>
9	<b>apple</b>	horse	ice cream

Figure 4. The number of accurate matching responses for the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Blocks of trials and interspersed trials.

## ACCURACY OF MATCHING RESPONSES

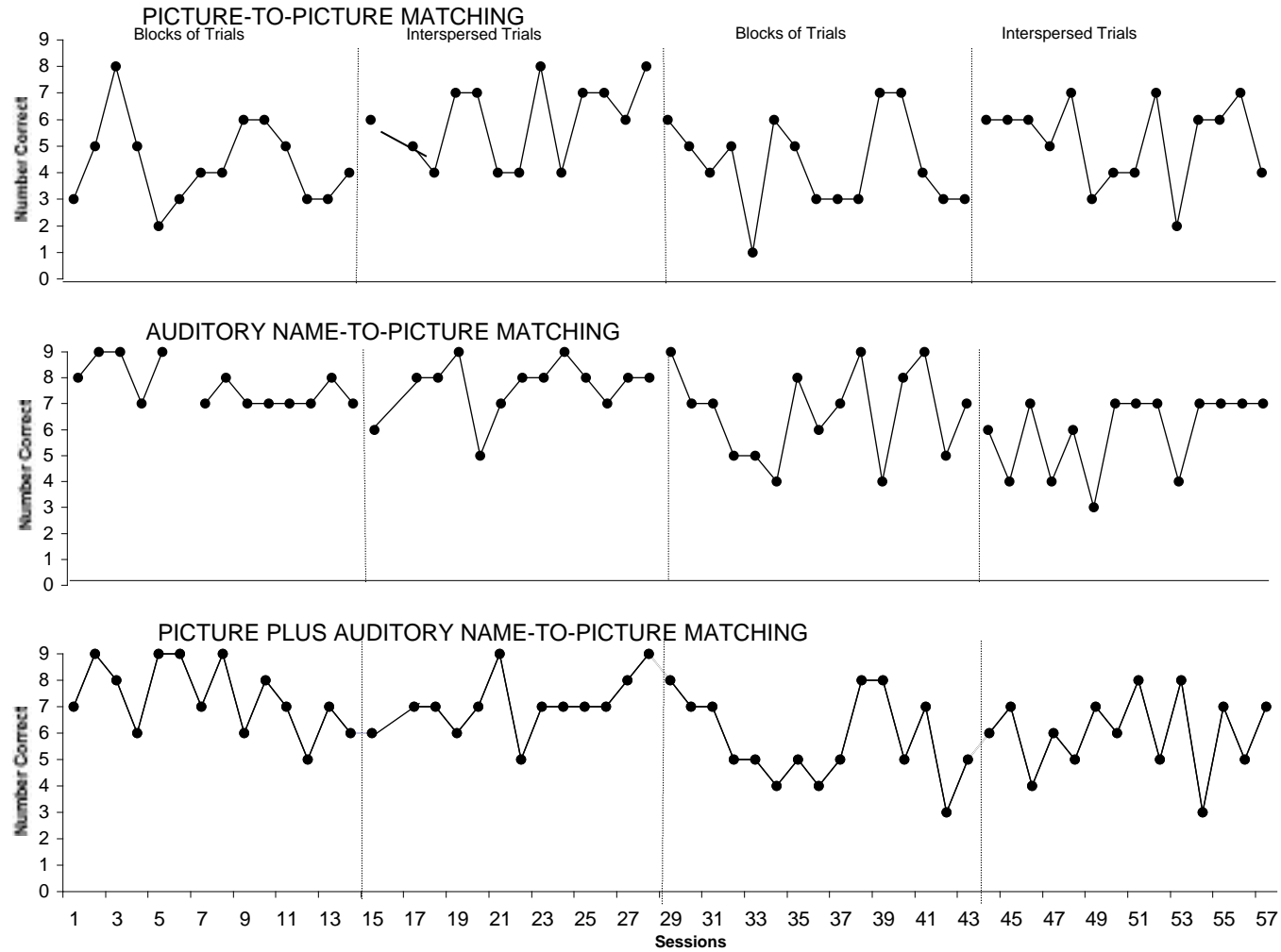


Figure 5. The position of matching responses (i.e., card placements) for the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Blocks of trials and interspersed trials.



## POSITION OF MATCHING RESPONSES

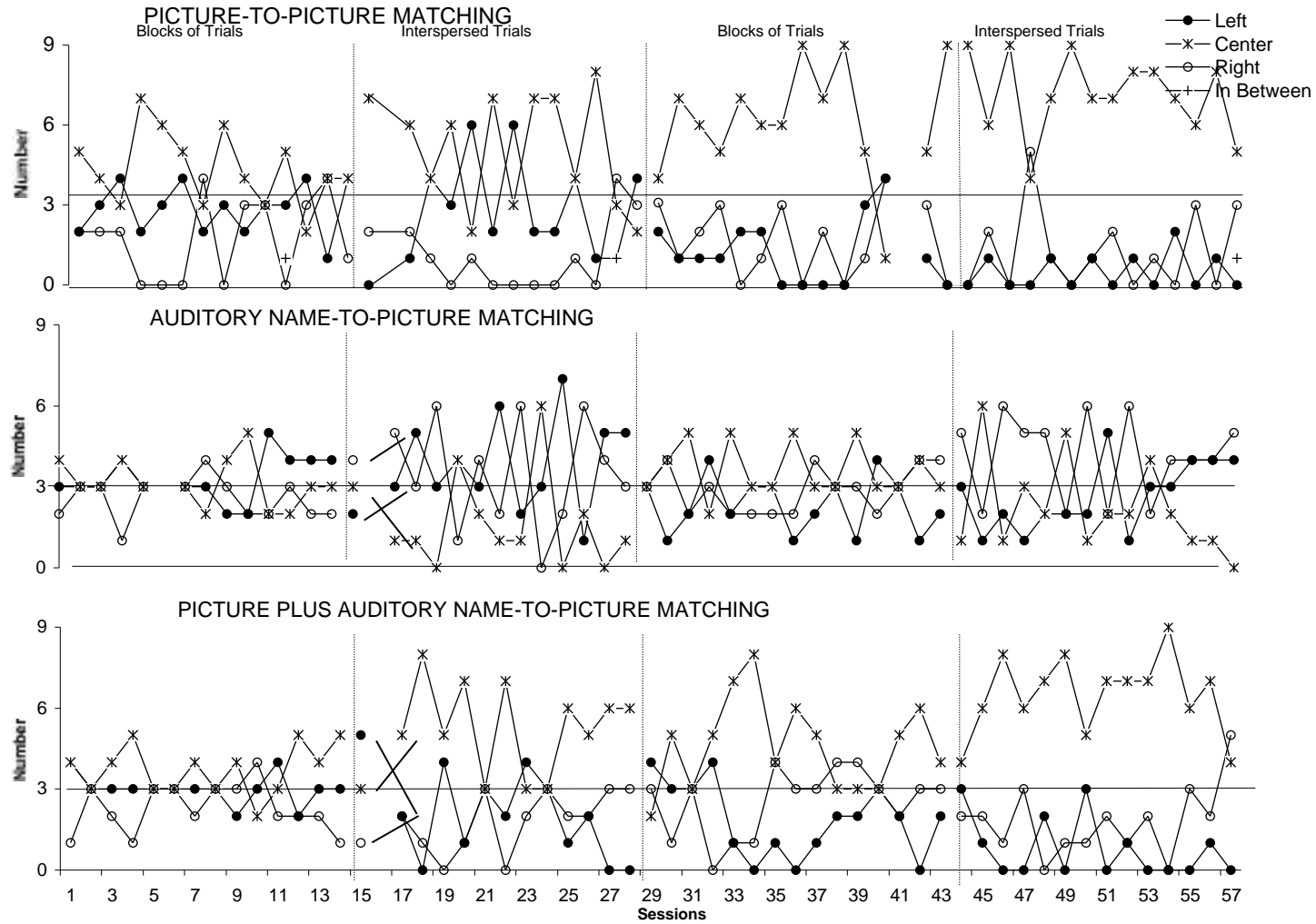


Figure 6. The total number of trials where the child looked away occurred in the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Blocks of trials and interspersed trials.

## LOOKING AWAY

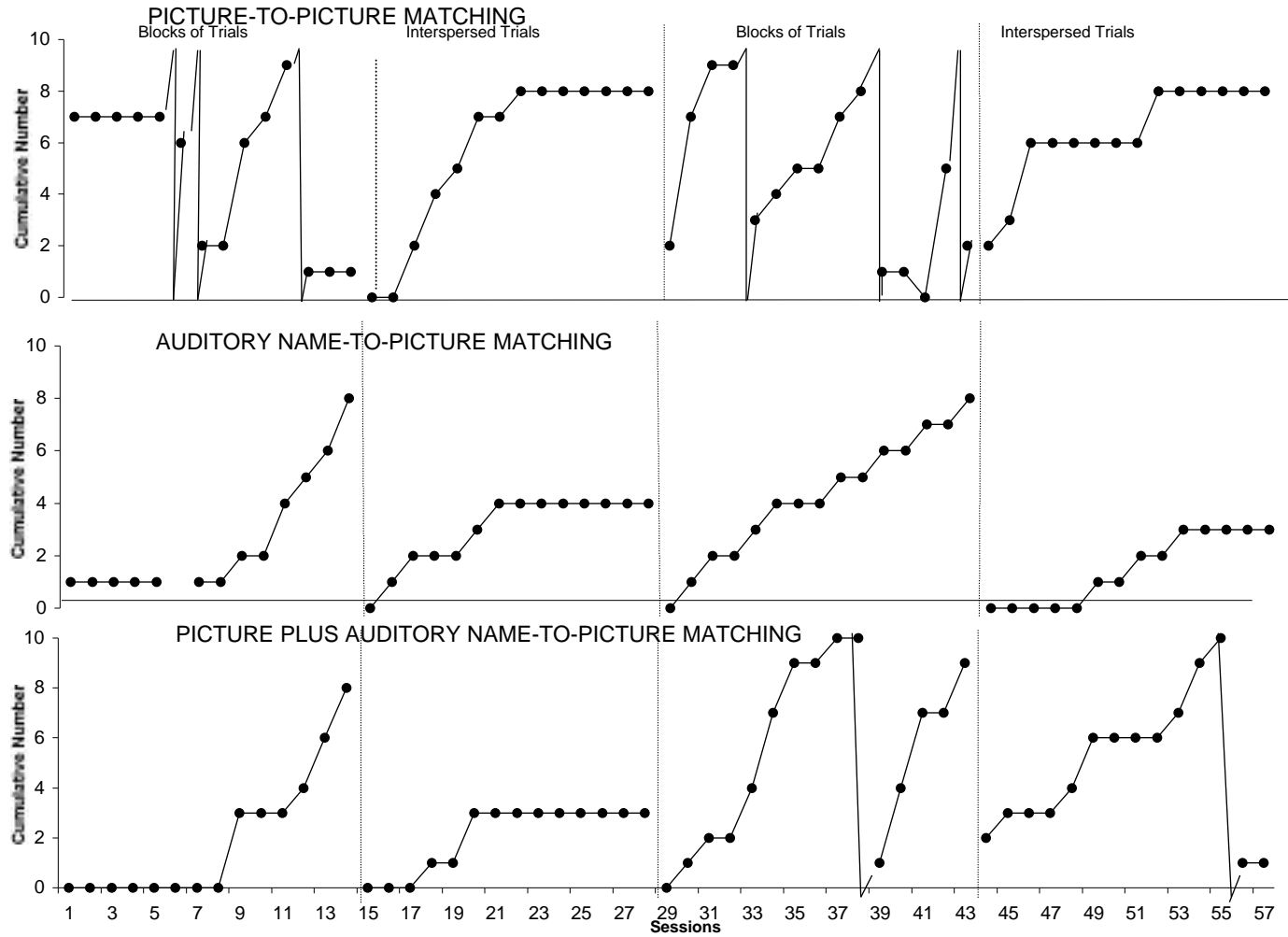


Figure 7. The total number of trials where face hitting episodes occurred during the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Blocks of trials and interspersed trials.

## FACE HITTING EPISODES

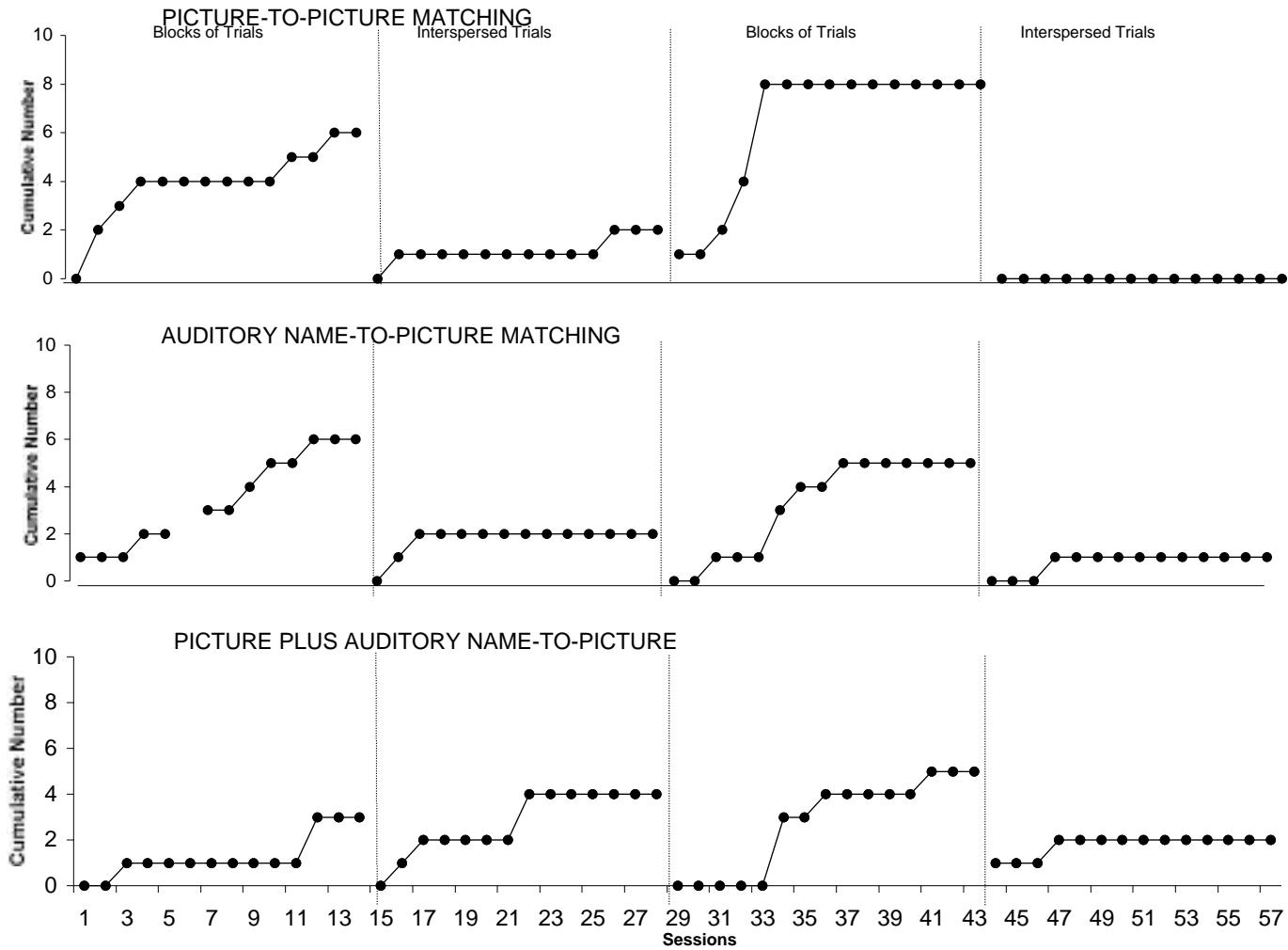


Figure 8. The number of accurate matching responses during Experiment 2 for the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Reinforce-corrects-only and reinforce-all-responses.

## ACCURACY OF MATCHING RESPONSES

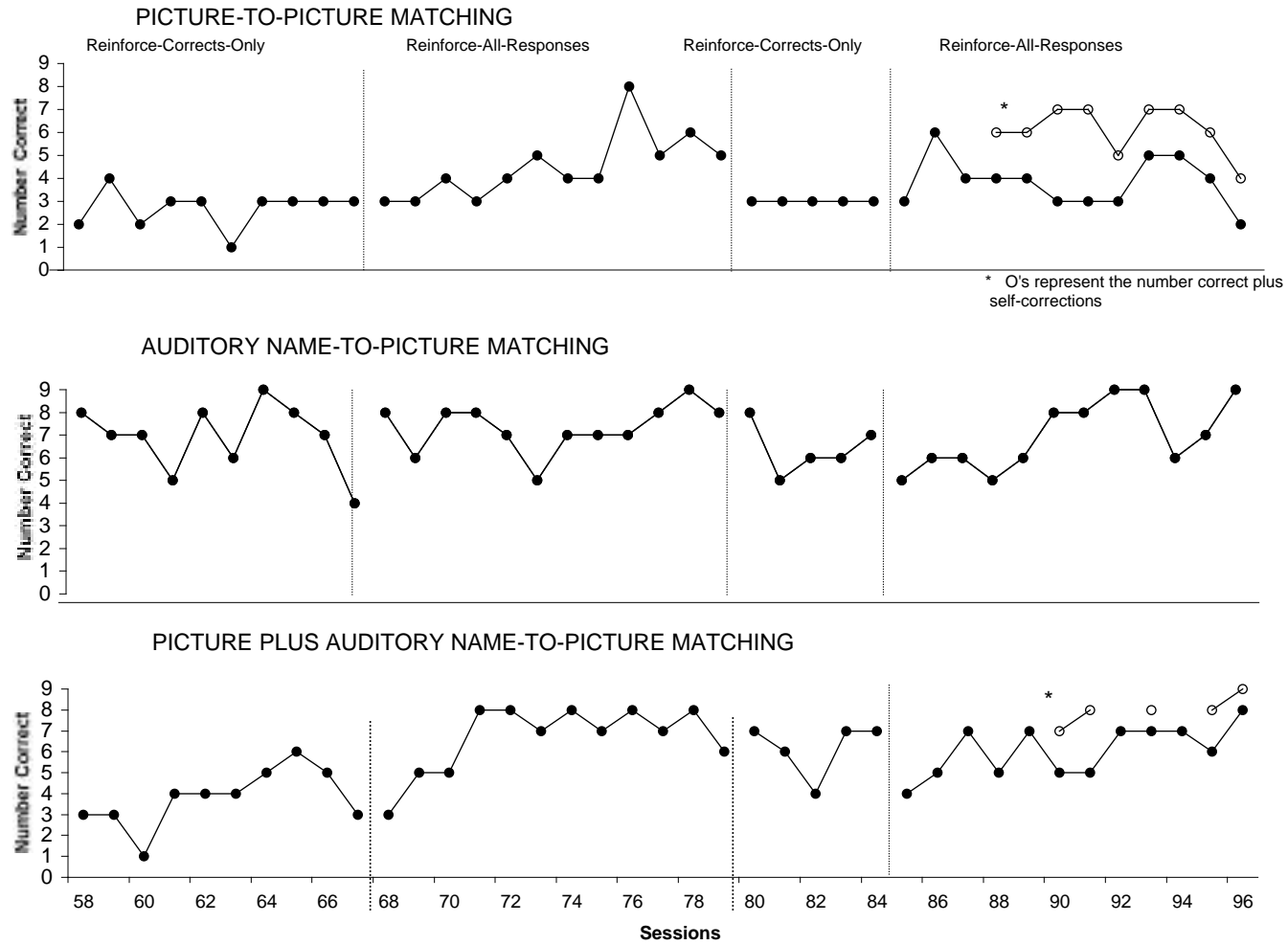


Figure 9. The position of matching responses (i.e., card placements) during Experiment 2 for the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Reinforce-corrects-only and reinforce-all-responses.



## POSITION OF MATCHING RESPONSES

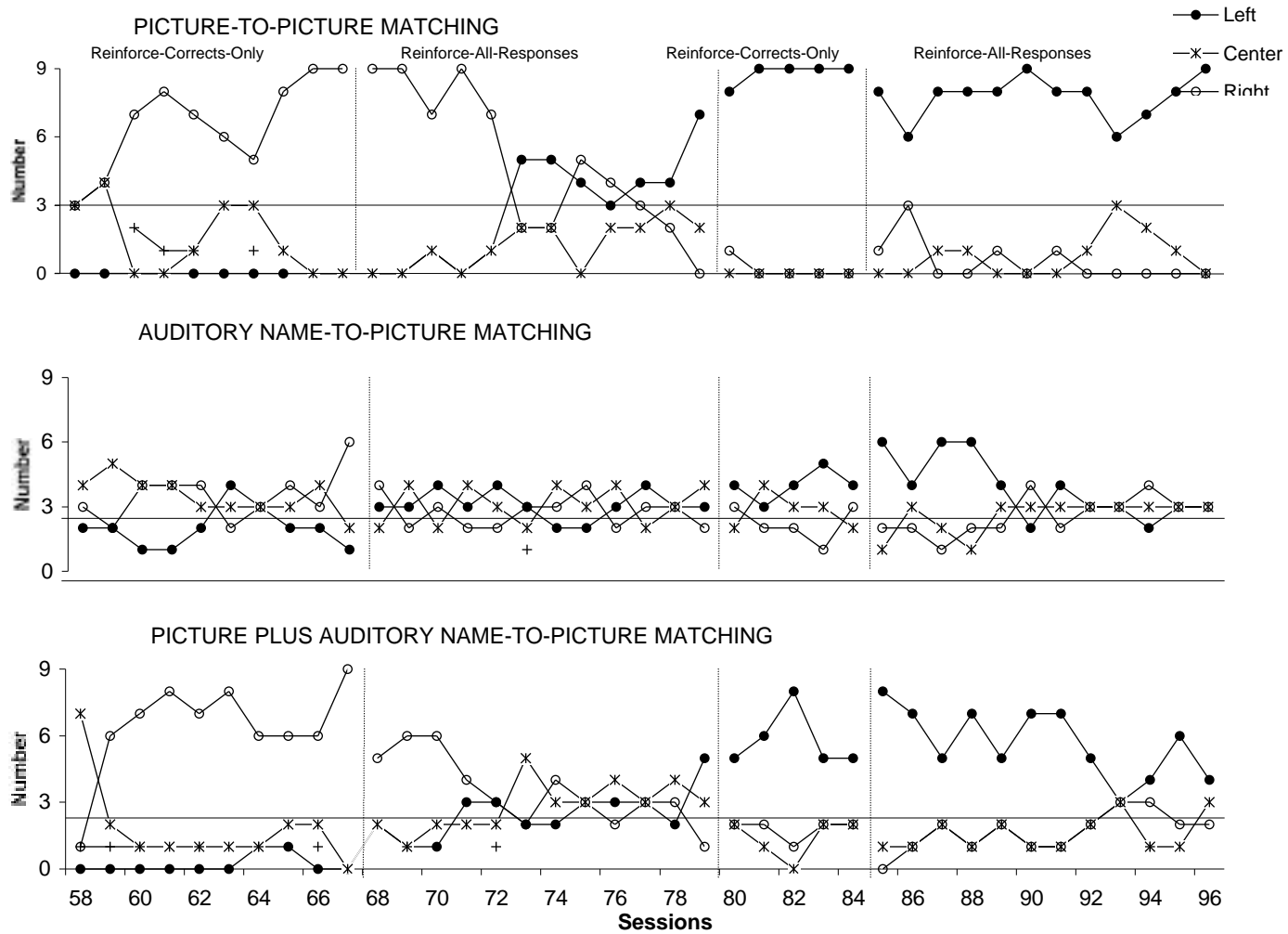


Figure 10. The total number of trials where the child looked away occurred during Experiment 2 in the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Reinforce-corrects-only and reinforce-all-responses.

## LOOKING AWAY

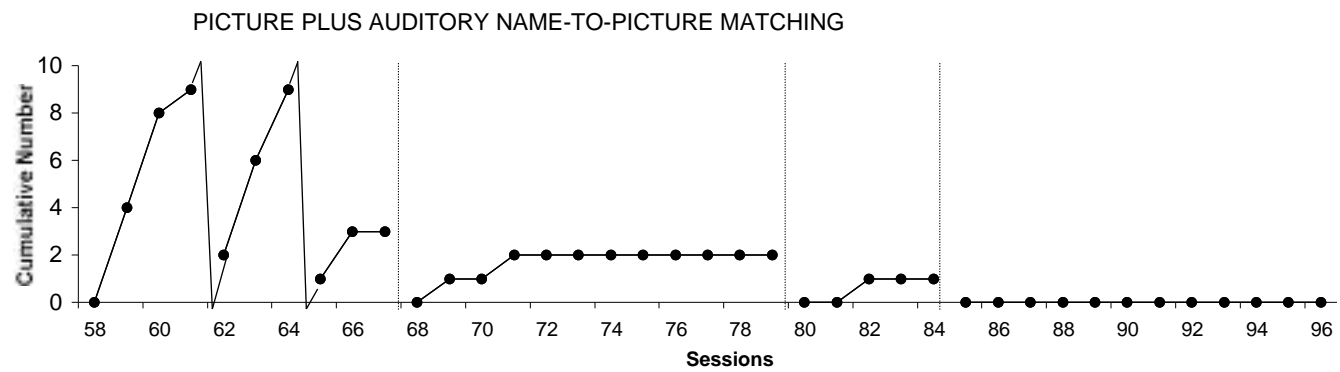
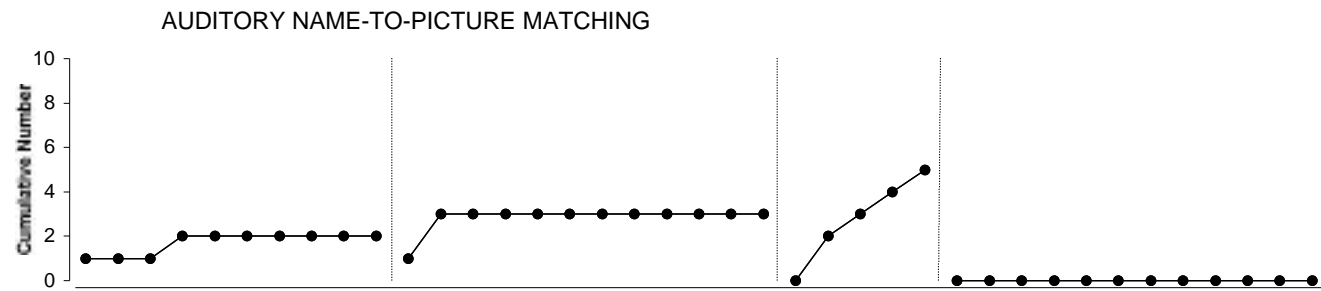
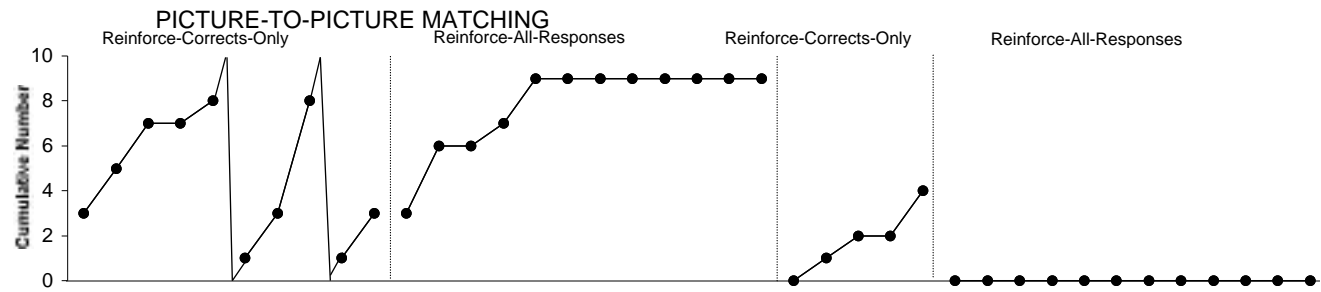
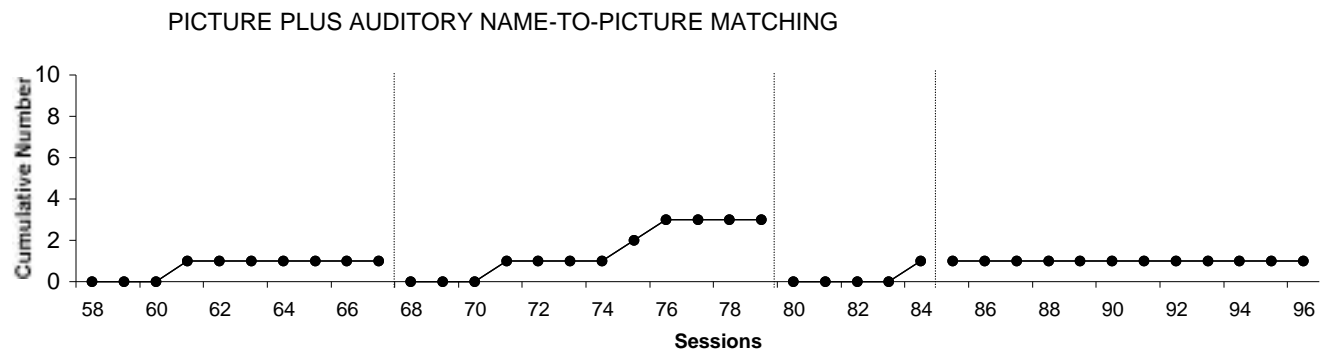
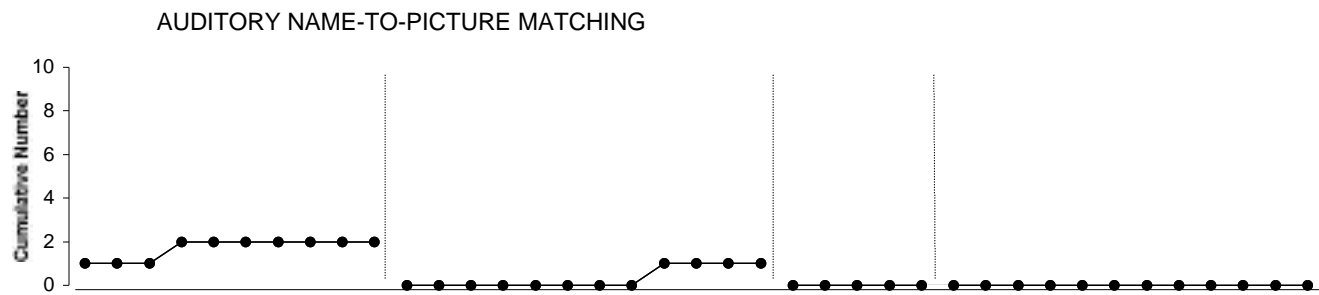
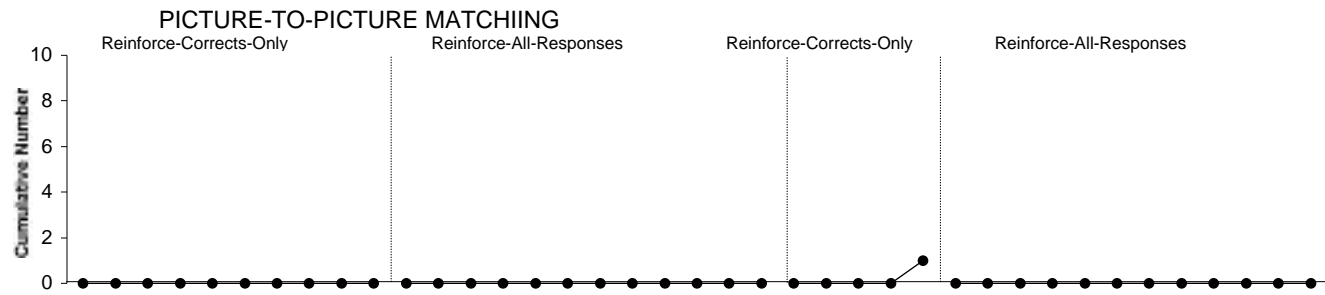


Figure 11. The total number of trials where face hitting episodes occurred in Experiment 2 during the picture-to-picture matching task (top graph), the auditory name-to-picture matching task (middle), and the picture plus auditory name-to-picture matching task (bottom) during both conditions: Reinforce-corrects-only and reinforce-all-responses.

## FACE HITTING EPISODES



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